A Recipe for Striga Control in Sub-Saharan Africa

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[Photo: Striga is a serious constraint to cereal crops such as sorghum.]

A 15-litre metal cooking pot, a handful of sorghum straw, and a gelatin capsule filled with a naturally occurring fungal strain may some day be all it takes to control the dreaded *Striga hermonthica* weed throughout sub-Saharan Africa, while generating income for rural women.

This simple recipe, which yields enough *Fusarium oxysporum* to treat four hectares of farm land for a whole year, is the product of an ambitious 10-year research effort funded by the International Development Research Centre (IDRC). The aim of the project, led by researchers at McGill University, is to develop a biological control weapon capable of destroying Striga — also known as 'witchweed' — before it penetrates the roots and stunts the growth of maize, millet, sorghum, and other crops.

Major constraint

"Striga is the major biological constraint to cereal production in Africa," says Alan Watson, Director of the McGill Biopesticide Research Laboratory. "It is causing land abandonment leading to rural exodus. About 40% of the cereal crops are infested in Africa and yields can be reduced by up to 100%, with an average yield reduction of 12-25%."

"Striga is such a difficult problem for farmers because they can't see it," adds Dr Watson. "It sucks the juices out of a cereal plant while it's still in the soil. It has done all of its damage before it even emerges from the ground. Other weeds can be controlled by hand, but not Striga. And there is continuous emergence throughout the growing season. So even if a farmer delays his planting, Striga is still going to infect, reducing crop growth and yield."

Fusarium versus herbicides

Nor are herbicides a viable solution, he notes, because they are beyond the reach of subsistence farmers and have little impact on the Striga weed while it remains in the soil. By contrast, the Fusarium fungus — which is found at low levels under natural conditions in some African soils — can be applied by coating cereal seeds first with arabic gum and then with dry fungal powder.

"It's a seed technology rather than a herbicide technology. The advantage with this approach is that Fusarium can colonize the soil and lie in wait for Striga. When Striga attacks the crops, it is killed by the Fusarium," says Dr Watson.

The hunt

The hunt for an effective biological control strategy began in 1991 when IDRC sent the McGill team to a Striga conference in Kenya. The same year, Dr Watson's research associate, Marie Ciotola, spent three months collecting diseased plant samples in Burkina Faso, Mali, and Niger.

Ciotola was searching for Striga plants that showed some sign of wilt or rot, which indicates the presence of a fungal pathogen in the plant. She isolated 250 organisms and selected several of the most promising to evaluate in a containment facility at McGill. One of the top candidates was *Fusarium oxysporum*. Not only did it attack the Striga plant, but it also destroyed the seeds.

Spectacular results

In 1994, field tests in Mali produced spectacular results: 90% of the Striga plants were wiped out while cereal plants remained untouched. At harvest time, sorghum yields doubled. Subsequent tests conducted in collaboration with Mali's Institut d'économie rurale confirmed these results. Meanwhile, laboratory studies back in Canada showed that this particular Fusarium strain produces no mycotoxins or phytotoxins, and hence poses no health threat to humans or animals.

After these successes, the next challenge was to devise a way to produce the fungus locally in the form of an inoculant. The McGill team first grew a Fusarium starter culture, which can be placed inside small gelatin capsules. According to Dr Watson, a one kilogram box of capsules will contain enough Fusarium inoculum to treat 3,000- 4,000 hectares of land.

Village level production

At the village level, traditional cooking pots can be sterilized over a fire and used to ferment a mixture of the starter culture and sorghum straw — a process that takes about 10 to 14 days. This mixture is then dried and can be stored for up to several months. When planting season arrives, farmers can take the dried Fusarium down from the shelf and incorporate it with their seeds. Once the seeds are in the soil, rain will activate the inoculant. The application rate of Fusarium is only 80 grams per hectare, says Dr Watson. By contrast, fertilizer must be applied at a rate of 100 kilograms per hectare.

Roger MacLean, a graduate student with the McGill team, suggests that the village-level manufacture of Fusarium can give women in rural communities more economic and social power. MacLean conducted an extensive socioeconomic study of 100 farms in Mali and determined that women could produce Fusarium in small-scale cottage industries and sell it to farmers. The preparation of the dried fungus both fits into women's traditional sphere of work and provides a new source of income.

Next steps

This year, Dr Watson and his colleagues plan to continue field testing Fusarium in six Mali villages. These experiments will involve local women in the production process and farmers in testing and data collection. Over the longer term, the researchers hope to introduce the fungus into other countries afflicted with Striga. "Our idea is to phase this technology in gradually, from village to village and then from country to country to country," he concludes. "We would also like to encourage the production of arabic gum, as a spinoff economic activity."

John Eberlee is the Managing Editor of IDRC Reports Online.

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If you have any comments about this article, please contact info@idrc.ca .

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